DOCUMENT RESUME

ED 351 453 CE 062 179

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TITLE	Perceived Educational Needs of Innovative Ohio Sawmill Operators. Summary of Research 66.
INSTITUTION	Ohio State Univ., Columbus. Dept. of Agricultural Education.
PUB DATE	92
NOTE	13p.
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Adult Education; Differences; *Educational Needs; Extension Education; *Forestry Occupations; *Innovation; *Lumber Industry; Needs Assessment; Regional Characteristics
IDENTIFIERS	*Ohio; *Sawmill Workers

ABSTRACT

The forest products industry is one of the largest manufacturing enterprises in Ohio. Sawmills are a well-known and visible manufacturing sector. This document reports on a descriptive correlational study that investigated perceived educational needs of innovative Ohio sawmill operators which could serve as a model for individuals conducting needs assessments in other occupational areas. Using survey research methodology, the study examined a purposive sample of 32 innovative Ohio sawmill operators nominated by a panel of experts. The data collection instrument was developed as a mail questionnaire. Part 1 of the instrument collected data on innovative Ohio sawmill operators' perceived importance and knowledge of 67 job competencies. Part 2 collected data on characteristics of the subjects. A response rate of 100 percent was achieved. The following were among the findings: (1) the most important educational needs were in the areas of sawmill production, forest product marketing, and environmental awareness; (2) 50% of respondents preferred less formal delivery methods; (3) Appalachian-area operators tended to have more tenure and be more innovative; and (4) perceived educational needs did not appear to be related to such characteristics as age, tenure, educational level, size of operation, income, or aspirations. Recommendations based on the findings were made to adult educators, adult education organizations, and researchers. (Five tables and 36 references are included.) (NLA)

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Summary of Research

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PERCEIVED EDUCATIONAL NEEDS OF INNOVATIVE OHIO SAWMILL OPERATORS

Stephen M. Bratkovich and Larry E. Miller

The Ohio forest products industry is one of the largest manufacturing enterprises in the state with an annual product value in excess of $7 billion. The industry directly employs approximately 60,000 workers with an annual payroll of over $1400 million (U. S. Department of Commerce, 1990). State government, private industry, and The Ohio State University (OSU) have recently reaffirmed their commitment to maintain and expand the Ohio forest products industry for the economic and social benefits that accrue to Ohio citizens.

Nationally, the Cooperative Extension System (CES) is generally segmented into the four program areas of agriculture, home economics, 4-H/youth, and community development (Warner and Christenson, 1984). In some states the program area of natural resources is included with agriculture and in others, like Ohio, the inclusion is with community development. Educational programs for the Ohio forest products industry fall within the mission of Extension and are included in the Ohio Cooperative Extension Service (OCES) program area of Community and Natural Resource Development.

Sawmills are a well known and visible manufacturing sector, comprising nearly 20% of all Ohio forest product industries. Although educational programs have been limited, sawmill personnel have traditionally received more attention by OCES than most other forest product industry manufacturing sectors (Touse, 1990).

In theory, educational programs developed and delivered by OCES are thoroughly planned. A crucial step in educational program planning is the assessment of need of the target audience. A needs assessment, according to Kaufman (1979), "in order to be responsive and responsible, must be accepted by the people it intends to serve. It must involve people in the identification of needs..." (p. 187). However, a formal educational needs assessment of Ohio sawmill operators has not been conducted.

The CES has a tradition of working closely with the innovative members in a social system to diffuse innovations (ideas, practices, or objects). The most innovative individuals (innovators) transport new ideas into a social system and thus, whether consciously or not, assist CES personnel in diffusing innovations. Opinion leaders, often called early adopters, are ahead of the average individual in innovativeness and "...serve as a role model for many other members of a social system. Opinion leaders are individuals who lead in influencing others' opinions about innovations ...and

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are generally sought by change agents to be a local missionary..." (Rogers, 1983, p. 249). Therefore, CES tradition, plus innovation diffusion theory, lend support for an educational needs assessment targeted at innovative Ohio sawmill operators.

Review of Literature

According to the literature (Borich, 1980; Gay, 1985; McKillip, 1987; Rossett, 1987; Ulschak, 1983; Witkin, 1977), the discrepancy definition of need (gap or discrepancy between 'what is' and 'what should be') popularized by Kaufman (1972), is used in the classical method of assessing educational needs. Although numerous scholars (English, 1977; Gay, 1985; Kaufman, 1987; Rossett, 1987; Witkin, 1984) support a consensus approach to needs assessment (including service providers, service receivers, and stakeholders in the process), in practice needs assessments in adult education frequently rely on formal input from only one "planning partner" (Anderson, 1982; Barrick, Ladewig, and Hedges, 1983; Borich, 1980; Dobbs, 1966; Ferry and Kiernan, 1989; Hester and McDowell, 1987; Uko, 1985). The Borich Model (Borich, 1980) operationalized needs assessment theory and has been used, or a modification thereof, in conducting agricultural education needs assessments (Alnassar, 1981; Barrick et al., 1983; Conklin, 1990; Ilkiuyoni, 1984; Shibah, 1983; Uko, 1985; Waters and Haskell, 1989).

Forest products industry needs assessments have not established relationships between demographic characteristics of personnel (age, income, attained educational level, gender, size of operation, tenure, and aspirations) and perceived educational needs, educational participation or innovativeness. However, researchers in other disciplines have reported on similar relationships which provided support for this research (Anderson, 1982; Cross, 1977; Cross, 1978; Cross, Tough, and Weathersby, 1978; Cross and Zusman, 1977; Dobbs, 1966; Ilkiuyoni, 1984; Knowles, 1970; Lovell, 1979; Merriam, 1988; Nichols, Rossing, Entine, Klessing, Steele, and Thomas, 1981; Rogers, 1983; Shibah, 1983; Uko, 1985).

Problem Statement and Research Questions

The following problem was investigated in this study: What are the perceived educational needs of innovative Ohio sawmill operators? The specific research questions investigated for innovative Ohio sawmill operators were:

1. Who are they and what are their characteristics?
2. What are their importance and knowledge perceptions of selected job competencies?
3. What are their a) perceived educational needs; b) perceived educational needs by subject matter area; and c) preferences for educational delivery method?
4. What are their differences, by geographic region, in a) characteristics; b) subject matter area perceived educational needs; and c) educational delivery method preference?
5. What are the relationships between their characteristics and their perceived educational needs by a) subject matter area; and b) geographic region for subject matter area?
6. What are the relationships between their characteristics and a) their delivery method preference; and b) their delivery method preference by geographic region?

Methodology

This study was designed as a descriptive correlational study which utilized survey research methodology. The 32 innova-

tive Ohio sawmill operators selected for this study were a purposive sample, nominated by a panel of experts. A researcher-developed instrument was used in data collection. The instrument was tested for content validity by a panel of experts and pilot tested on Ohio sawmill operators with similar demographic characteristics as the target population. Cronbach's alpha reliability estimates, which ranged from .69 to .93, were calculated to establish the internal consistency of the instrument.

The data collection instrument was developed as a mail questionnaire. Part one of the instrument collected data on innovative Ohio sawmill operators' perceived importance and perceived knowledge of 67 job competencies. The competencies were divided into the six subject matter areas of forest product marketing, sawmill production, equipment maintenance and management, communications, environmental awareness, and business management. Part two of the instrument collected data on characteristics of the subjects. Two mailings of the questionnaire which included advance and reminder postcards, plus telephone and face-to-face follow-up, achieved a response rate of 100%.

The data generated from the mail questionnaires were analyzed with the Statistical Package for the Social Sciences/Personal Computer software (SPSS/PC+) available in the Department of Agricultural Education at OSU. The Borich needs assessment model was used to compute perceived educational needs from importance and knowledge scores. Statistics employed included frequencies, percentages, measures of central tendency, measures of dispersion, Kendall's tau c coefficient, Cramer's V statistic, and the chi-square test of significant difference.

Though this study was a census, inferential statistics were employed as innovative Ohio sawmill operators were considered a sample at one point in time. Results were generalizable only to the innovative Ohio sawmill operators investigated. An alpha level of .05 was selected a priori.

Findings and Conclusions

Innovative Ohio sawmill operators and their characteristics. From the total of 32 innovative Ohio sawmill operators, 21 operators (66%) resided in the geographic region of Appalachian Ohio and the remaining 11 (34%) Ohio operators resided in non-Appalachian counties. The majority of innovative operators, therefore, were clustered within the 28 counties of Appalachian Ohio.

Based on the median, a conclusion was that the typical innovative Ohio sawmill operator was a 45 - 54 year old male who had a tenure of 20 - 29 years, had some college education, annually produced 5 - 6.9 million board feet of lumber, generated an annual income of $3 - 4.9 million, and had strong aspirations to seek new information.

Perceived importance, knowledge, and educational needs of innovative Ohio sawmill operator competencies. Operators scored the 67 competencies on the importance of the competency to their job as well as their knowledge level of the competency. The instrument scale continuum was from 1 (low) to 5 (high). For interpretation of importance and knowledge mean scores, the scale was trichotomized into scores of low (1.0 - 2.3), medium (2.4 - 3.6), and high (3.7 - 5.0). For educational need, a positive mean score represented a situation where the importance score was greater than the knowledge score, i.e., a perceived educational need existed. The greater (or lesser) the computed need mean score (importance score minus knowledge score multiplied by mean importance score), the greater (or lesser) was the perceived educational need.

Table 1 presented the 21 competencies with the highest need mean scores along with importance and knowledge scores for the same competencies. The findings indicated that the use of only importance or knowledge score rankings to assess educational needs were faulty. This conclusion was supported by numerous researchers (Alnassar, 1981; Barrick et al., 1983; Ilkiuyoni, 1984; Shibah, 1983; Uko, 1985). The exporting lumber competency, for example, had mean score ranks of 39 for importance, 59 for knowledge, and 3 for perceived educational need.

Table 2 ranked the job competencies by the six subject matter areas. Innovative Ohio sawmill operators rated the sawmill production subject matter area as first in both importance and knowledge but the areas of forest product marketing and environmental awareness had the highest perceived educational need. Therefore, educational programs that targeted the two latter subject matter areas would be consistent with the perceived needs of the operators.

Delivery method preference for educational programs. Fifty percent of innovative Ohio sawmill operators preferred a less formal method of educational program delivery (one-on-one contact) as compared to the formal method of group education (28.1%). Approximately 22% of the operators preferred the self-study delivery method. A statistically significant difference was not found for educational delivery method preference by geographic region of Ohio.

Geographic region differences in characteristics and perceived educational needs. The chi-square test of significant difference compared the characteristics of innovative Ohio sawmill operators and geographic region. Age was the only characteristic statistically significant by geographic region (Table 3); Appalachian sawmill operators (modal age $\geq$ 45 yrs.) tended to be older than non-Appalachian operators (modal age $\leq$ 44 years). Since age has been found to be inversely related to participation in adult education (Cross, 1978; Cross and Zusman, 1977; Lovell, 1979), Appalachian Ohio sawmill operators may be less likely to participate in educational programs than non-Appalachian operators.

Although not significant at the .05 level, Appalachian operators tended to have more tenure in the sawmill industry and generated more income than non-Appalachian operators. Since social status, which includes income and prestige, has been found to be positively related to innovativeness (Rogers, 1983), Appalachian operators, in this study, may be more innovative than their non-Appalachian counterparts.

The chi-square test of significant difference compared subject matter area educational needs of innovative Ohio sawmill operators and geographic region. Significant statistical differences were not found between any of the six subject matter areas and geographic region. Therefore, educational programs developed for innovative operators would be applicable on a statewide basis.

Relationships between characteristics and perceived educational needs. Kendall's tau c coefficient (T) was computed as a measure of relationship between characteristics (ordinal scale) and educational need (interval scale) after converting educational need scores to rank orders (ordinal scale). On a statewide basis, the subject matter area perceived educational needs of innovative Ohio sawmill operators were not related from a practical standpoint to the characteristics investigated in this study (Table 4). All coefficients in Table 4 indicated either a negligible or low relationship (Davis, 1971) between characteristics and perceived educational needs with the excep-

Table 1

DESCRIPTIVE STATISTICS OF COMPETENCIES WITH HIGHEST NEED MEAN SCORES

Competencies	Importance			Knowledge			Need		
	Rank	$\bar{X}$	SD	Rank	$\bar{X}$	SD	Rank	$\bar{X}$	SD
Predicting future lumber prices	3	4.5	0.8	45	3.1	0.9	1	6.3	4.1
Understanding environmental laws enforced by regulatory agencies	22	4.0	1.0	54	2.7	0.9	2	5.4	4.9
Exporting lumber	39	3.7	1.3	59	2.6	1.2	3	4.0	5.7
Motivating employees	8	4.4	0.9	25	3.5	1.0	4	3.9	4.9
Disposing of sawmill wastes in an environmentally safe manner	8	4.4	1.0	23	3.6	1.2	5	3.8	5.2
Evaluating new mfg. technologies	22	4.0	1.1	45	3.1	0.9	6	3.7	4.1
Evaluating log yield/lumber output	3	4.5	0.8	12	3.7	1.0	7	3.5	4.6
Keeping up-to-date on worker compensation issues	11	4.3	1.0	32	3.4	1.0	8	3.4	3.8
Preventing sapstain on lumber	1	4.7	0.7	2	4.0	1.0	9	3.3	4.5
Conserving energy at the sawmill	22	4.0	1.2	39	3.2	1.3	9	3.3	4.8
Developing new wood products	42	3.6	1.5	54	2.7	1.1	9	3.3	5.8
Resolving problems with employees	3	4.5	0.9	8	3.8	1.0	12	3.2	4.0
Recognizing differences between marketing and selling	28	3.9	1.1	45	3.1	1.1	13	3.0	5.1
Marketing domestic lumber	11	4.3	1.1	12	3.7	1.1	14	2.8	4.6
Projecting a good image to customers	2	4.6	0.8	2	4.0	0.9	15	2.7	3.3
Controlling noise in the sawmill	28	3.9	1.1	39	3.2	1.0	15	2.7	4.0
Maintaining an adequate log supply	3	4.5	1.0	5	3.9	1.2	17	2.6	4.1
Correcting mill safety problems	8	4.4	0.9	8	3.8	0.9	17	2.6	4.2
Controlling wood dust in the sawmill	42	3.6	1.2	52	2.9	1.2	19	2.5	3.7
Projecting a good image to the general public	11	4.3	1.0	12	3.7	1.0	19	2.5	3.9
Developing an efficient pattern of material flow through the sawmill	3	4.5	0.8	5	3.9	1.1	19	2.5	4.3

Table 2

DESCRIPTIVE STATISTICS OF COMPETENCIES BY SUBJECT MATTER AREA

Subject Matter Area	Importance			Knowledge			Need		
	Rank	$\bar{X}$	SD	Rank	$\bar{X}$	SD	Rank	$\bar{X}$	SD
Forest product marketing	4	3.7	0.8	3	3.2	0.6	1	2.3	3.2
Environmental awareness	3	3.8	0.9	3	3.2	0.8	1	2.3	2.6
Sawmill production	1	4.1	0.6	1	3.6	0.6	3	2.0	2.5
Communications	2	3.9	0.8	2	3.5	0.8	4	1.7	2.3
Business management	5	3.6	0.8	3	3.2	0.7	5	1.5	1.8
Equipment maintenance & management	6	3.2	1.1	6	3.0	0.9	6	0.6	1.9

Table 3

CHI-SQUARE TEST OF SIGNIFICANT DIFFERENCE BETWEEN CHARACTERISTICS OF INNOVATIVE OHIO SAWMILL OPERATORS AND GEOGRAPHIC REGION OF OHIO

Characteristic	X^2	d.f.
Age	6.22*	1
Tenure	3.79	2
Educational level	.93	2
Size of operation	1.00	1
Income	3.01	1
Aspirations	1.00	1

Note: Yates' correction was applied to the X^2 statistic where d.f. = 1.
*$p < .05$

Table 4

RELATIONSHIPS BETWEEN INNOVATIVE OHIO SAWMILL OPERATORS' CHARACTERISTICS AND PERCEIVED EDUCATIONAL NEEDS

Subject matter area	Kendall's tau c coefficient (τ)					
	Age	Tenure	Education level	Size of Operation	Income	Aspirations
Forest product marketing	.14	.09	-.10	.11	-.15	.20
Sawmill production	-.06	-.07	-.04	.01	-.08	.29
Equipment management and maintenance	-.16	-.18	-.07	-.14	-.21	-.03
Communications	-.02	-.02	-.14	-.18	-.34	.09
Environmental awareness	.09	.02	.07	.02	-.25	.24
Business management	.10	.10	-.22	-.04	-.18	.23

tion of the moderate negative relationship (T = -.34, T^2 = .12) between income and the communications subject matter area.

Relationships between characteristics and perceived educational needs by geographic region were identified (Table 5) with the majority of the relationships either low or negligible. For Appalachian operators, the moderate relationships were negative whereas for non-Appalachian operators the moderate, substantial, and very high relationships were positive. This finding may warrant consideration by educators when developing programs for innovative sawmill operators on a regional or local level.

Relationships between characteristics and delivery method preference. Cramer's V statistic was utilized to correlate characteristic (ordinal scale) with delivery method preference (nominal scale). On a statewide basis, a moderate relationship existed between delivery method preference and the characteristics of age, size of operation, and aspirations (Cramer's V = .33, .34, and .35, respectively). For non-Appalachian operators, the relationships between delivery method preference and characteristics were moderate to substantial with Cramer's V ranging from .43 (education level) to .62 (aspirations). Cramer's V statistic for Appalachian operators ranged from .28 (tenure) to .65 (income).

Using the Cramer's V indices as well as contingency table marginal and cell proportions, the following conclusions were drawn. First, the educational delivery method of one-on-one contact was generally preferred by operators in both Ohio geographic regions. Second, regardless of geographic region, older operators and operators with a low educational level preferred one-on-one contact. Third, group education was preferred by non-Appalachian opera-

Table 5

RELATIONSHIPS BETWEEN INNOVATIVE OHIO SAWMILL OPERATORS' CHARACTERISTICS AND PERCEIVED EDUCATIONAL NEEDS BY GEOGRAPHIC REGION OF OHIO

	Kendall's tau c coefficient (T)[a]					
Subject matter area	Age	Tenure	Education level	Size of Operation	Income	Aspirations
Forest product marketing	.09 / .35	.01 / .18	-.23 / .12	-.04 / .35	-.16 / -.16	.21 / .33
Sawmill production	-.11 / .18	-.10 / .04	-.11 / .08	-.08 / .22	-.13 / .04	.24 / .73
Equipment management & maintenance	-.07 / -.09	-.11 / -.18	-.16 / -.08	-.15 / .00	-.19 / -.08	-.01 / .20
Communications	.14 / .09	.04 / .09	-.16 / -.27	-.26 / .26	-.31 / -.21	.09 / .13
Environmental awareness	.12 / .18	.03 / .04	.11 / -.04	-.24 / .40	-.40 / -.08	.29 / .20
Business management	.20 / .04	.12 / -.04	-.37 / .08	-.15 / .04	-.26 / -.16	.16 / .53

[a]Correlation coefficients above the line (numerator) are for Appalachian sawmill operators. The coefficients below the line (denominator) are for non-Appalachian operators.

tors who possessed one or more of the following characteristics: young age, small size of operation, high level of education, and high aspirations. Fourth, young operators (statewide) tended to prefer either group education or the self-study delivery method.

Recommendations

Based on the findings and conclusions of this study, the following recommendations were made.

Recommendations to Adult Educators

1. Initial programming efforts should focus on the highest ranked educational needs.
2. Programming efforts should concentrate on competencies (topics) related to the subject matter areas of forest product marketing and environmental awareness. The rationale for this recommendation was based on the conclusion that the previously mentioned subject matter areas had the highest ranked educational needs.
3. Decisions on educational program priorities should consider topics that produce outcomes (adoption of new ideas and practices) that have the highest probability of being diffused from the innovative sawmill operators to the non-innovative operators (early and late majority). The attributes of new ideas and practices which should be evaluated in the program planning process are, according to Rogers (1983), relative advantage, compatibility, complexity, trialability, and observability.
4. Sophisticated, high technology educational topics should not be avoided when programming for innovative sawmill operators. This recommendation was justified since the typical innovative operator was experienced (tenure of 20 - 29 years), had a minimum education of "some college", and had strong aspirations to seek new information.
5. Programming efforts should include coordination and cooperation of adult educators in different organizations. Because numerous needs were identified in this study, adult educators in a given organization will not, working independently, have the expertise, personnel, or financial resources to adequately service the needs of sawmill operators.
6. Caution should be used if future identification of sawmill operator educational needs are not based on a discrepancy analysis. A conclusion from this study indicated that, for example, perceived importance of a competency (potential educational topic) did not necessarily correspond to a perceived need.
7. Educational programs should be planned with a consideration of delivering the programs with less formal methods. Less formal methods could include items such as program location (big city vs. small town), program format (lecture vs. group discussion), and attire (business suit vs. casual dress).
8. Different program development and delivery strategies should be considered for the two geographic regions in Ohio. This recommendation was supported by the conclusion that Appalachian operators, because of their age, might be less likely to participate in educational programs than non-Appalachian operators.
9. Educational programs piloted and deemed successful in one geographic region should be offered in the other region because subject matter area perceived educational needs did not differ significantly by region. Suc-

cessful programs, however, might need to be "re-packaged" (change in delivery method for example) when transferred from one region to another.

10. Creative programming strategies should be investigated for older sawmill operators and operators with a low level of education. These operators undoubtedly include many opinion leaders who must be reached by educators so that innovation diffusion will occur in a timely fashion. Older and less educated operators tended to prefer one-on-one contact which might not be economically feasible if one-on-one implies a "personal visit" to the operator by an educator; a toll-free telephone service, however, might be more feasible.

Recommendations to Adult Education Organizations

1. An increase in personnel and financial resources should be allocated (by OSU, OCES, and Ohio Department of Natural Resources) to address the numerous subject matter area needs that were identified in this study.
2. Personnel and financial resources for educational programs should be committed within the time frame of a strategic plan (5 - 10 years) or beyond. A short-term planning horizon does not enable educational programs (delivered to distant audiences) to achieve a degree of impact and momentum which results in programs attaining self-renewing behavior on the part of the adult learner. This recommendation was supported by the view of Rogers (1983) that one of the major roles of a change agent (educator) should be to stabilize adoption of new ideas and practices and prevent discontinuance.
3. Inter-agency efforts to plan, develop, and deliver educational programs should be encouraged and supported.
4. Linkages should be established with organizations (departments, colleges, etc.) that traditionally have not been actively involved in sawmill operator education. For example, marketing expertise in the OSU Department of Agricultural Economics and Rural Sociology and the College of Business could be utilized by OCES in programming efforts relating to the forest product marketing subject matter area.
5. Organizational support should be provided for educators who take risks in planning, developing, and delivering creative programs to a traditionally hard-to-reach audience.

Recommendations for Further Research

1. The innovative sawmill operators studied in this research were not necessarily representative of the "average" sawmiller in the state. Further research should replicate this study to determine the needs and characteristics of non-innovative Ohio sawmill operators (early majority, late majority, and laggards).
2. If innovative sawmill operators in adjoining states had similar educational needs, then organizational resources could be pooled in certain instances and selected educational programs conducted on a regional basis. Consequently, this study should be replicated in neighboring states.
3. The educational needs of sawmill employees were not investigated in this study. Future research should target this clientele group.
4. The intuitive judgement of this re-

searcher is that forest product marketing and environmental awareness educational needs, which were the highest ranked subject matter area needs in this study, would also be highly ranked by operators of secondary manufacturing forest product industries (dry kilns, pallet mills, furniture plants, etc.). However, the educational needs of loggers, for example, might be different. Further research should explore the educational needs of operators and employees in various forest product industry sectors.

5. Kaufman (1987) argued that a complete needs assessment should include learners (innovative sawmill operators in this study), educators, and community members (often called stakeholders). Consequently, further research should assess the needs of sawmill operators from the perspective of educators (expert panel) and stakeholders (forestland and forest product users, allied industry sectors such as loggers, local community officials, etc.).

6. Several studies of adult learners have focused exclusively on delivery method preferences. The data collection instrument for this study, however, included only one item on delivery method preference. Future research can contribute to the knowledge base of innovative sawmill operators by investigating in more depth preferred delivery methods.

7. Due to the small number of subjects in this study (n = 32), extreme care was used to develop a data collection instrument that was easy to complete, thus increasing the response rate. A decision was made, therefore, to collect ordinal level data on the characteristics of the subjects since ordinal level data appears less threatening than interval level data (a subject, for example, may resist reporting an exact dollar figure for their income but will report an income range). Consequently, precision was sacrificed in this study for the sake of completeness. Future research, however, should attempt to provide a more precise description of the characteristics of innovative Ohio sawmill operators.

8. Long (1990) noted that the number of Ohio sawmills has declined 25 percent since 1984. However, research has not been conducted that described the changing (if any) characteristics of the sawmill industry. For example, are sawmills becoming larger or smaller? Are operators younger or older? Are sawmill numbers decreasing at the same rate by geographic region in Ohio? Further research should include a longitudinal study to monitor, over time, the characteristics of the Ohio sawmill industry.

9. Three highly ranked needs from this study which had identical mean scores on perceived need were: preventing sapstain on sawn lumber, conserving energy at the sawmill, and developing new wood products. When educational programs are conducted in the previously mentioned topics, what outcomes (new ideas and practices) of the educational programs possess the necessary attributes to increase their rate of adoption? Which topic (and resulting outcomes), therefore, has the greatest chance of being rapidly diffused from innovative sawmill operators to non-innovative operators? Further research should investigate the relationship between sawmill innovation attributes and innovation diffusion.

10. The innovative sawmill operators investigated in this study were larger (size of operation and income) than

the typical Ohio operator. Consequently, the impact of innovative sawmill operators upon the forest resource (acres harvested, logging roads constructed, etc.) is greater. Additional research should be conducted to determine the perceived forest management needs and perceived forest stewardship responsibilities of innovative sawmill operators.

11. Private non-industrial forestland owners provide the vast majority of the raw material (timber) utilized by Ohio sawmill operators. Ohio sawmills will decline or cease to operate if private non-industrial forestland owners restrict timber output from their lands. Further research should investigate landowner attitudes in relation to their forest management and timber harvesting objectives.

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SUMMARY OF RESEARCH SERIES

The forest products industry is one of the largest manufacturing enterprises in Ohio, employing 60,000 workers and yielding an annual product value in excess of $7 billion. Sawmills are a well known and visible manufacturing sector, comprising nearly 20% of all Ohio forest product industries. This study examines the perceived educational needs of innovative Ohio sawmill operators. It should serve as a useful model for individuals conducting needs assessments in other occupational areas.

This summary is based on a dissertation by Stephen M. Bratkovich under the direction of Larry E. Miller. Stephen Bratkovich was a graduate student in the Department of Agricultural Education at The Ohio State University. He currently is an Assistant Professor for the Ohio Cooperative Extension Service at The Ohio State University. Dr. Miller is Professor, Department of Agricultural Education, The Ohio State University. Special appreciation is due Bob R. Stewart, University of Missouri-Columbia and John Hillison, Virginia Tech for their critical review of the manuscript prior to publication.

Research has been an important function of the Department of Agricultural Education since it was established in 1917. Research conducted by the Department has generally been in the form of graduate theses, staff studies, and funded research. It is the purpose of this series to make useful knowledge from such research available to practitioners in the profession. Individuals desiring additional information on this topic should examine the references cited.

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1992

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